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Notes on Intraspecific Variation and Sexual Dimorphism of Some Palaearctic Species in the Genus *Hylastes* ER. (Col., Scolytidae)

[Pp. 553—584, 16 text-figs.]

Uwagi o zmienności osobniczej i dymorfizmie płciowym niektórych palearktycznych gatunków rodzaju *Hylastes* ER. (Col., Scolytidae)

Замечания о индивидуальной изменчивости и половом диморфизме некоторых палеарктических видов рода *Hylastes* ER. (Col., Scolytidae)

Abstract. The authors present results of their studies on individual variation and sexual dimorphism of some palaearctic species in the genus *Hylastes* ER. (*H. ater* PAYK., *H. brunneus* ER., *H. cunicularius* ER., *H. opacus* ER., *H. attenuatus* ER., *H. angustatus* HERBST). Results of a mathematical analysis permit to state that the use of the pronotal and elytral ratios of length to breadth gives no certainty in the identification of the mentioned species. The present studies, however, permitted to find characters, with the use of which it is possible to identify certainly species and sex in the group of large bast bark beetles and species in the group of small bast bark beetles. On the basis of essentially distinguishing characters the key for the identification of the studies species has been worked out.

“...Especially large species of pine bast beetles, such as *Hylastes subalpinus* EGG., *H. aterrimus* EGG. and *H. parallelus* (CHAP.), found in Japan, Siberia and Northern Europe and even in the southern part of the Tatra Mountains, should be thoroughly revised; their characters presented as distinguishing are so subtle that their species-specific value is very problematic. With great intraspecific variation of pine bast beetles, these characters completely lose their value...”

(M. NUNBERG 1954)

Introduction

In the abundant literature concerning different species of the genus *Hylastes* ER., these species distinguishing characters based mainly on the morphology are taken into consideration. Among characters used in the identification of concrete species there are also such, which make a correct identification of species difficult and sometimes even impossible. They are either uncritically repeated by authors one after another (BALACHOWSKY 1948, BLAIR 1949, DUFFY 1953, NUNBERG 1954, PFEFER 1948, 1955, REITER 1913) or misinterpreted with little changes.

There are very few authors elucidating a wrong interpretation of morphological characters (STARK 1952, HANSEN 1954, LEKANDER 1965, SCHEDL 1968 and recently BEAVER 1970), but even in these few works by the mentioned authors many inaccuracies can be found.

The aim of the present studies was to elucidate some errors found most frequently and to establish the most distinguishing specific characters in showing simultaneously the intraspecific variation and sexual dimorphism of some species in that genus.

The most common species in Poland is *Hylastes ater* PAYK. Specimens of this species seem to be most varying of all known species, and for that reason we have focused our main attention on that species. Although this species is very common, there is no satisfactory description making possible a correct identification of all its specimens. As reported by LEKANDER (1965) the lectotype of *H. ater* PAYK. is the female, on the basis of which he made „a new description of the species”. However, the existing great sexual dimorphism does not permit a correct identification of males according to the same description.

All the authors mentioned in this introduction give the ratio of the pronotal length to breadth and that of the elytral length to breadth, in figures or descriptively, as a distinguishing character of the discussed species in the genus *Hylastes* ER. This character, as well as other morphological characters, makes impossible a strict determination of these beetles. In our studies the separation of *H. ater* PAYK. from *H. brunneus* ER. gave us the most trouble on account of great intraspecific variation. For that reason it was necessary to prepare copulatory organs, which gave us the basis for an errorless determination of the species.

In the European literature only HANSEN (1954), LEKANDER (1965) and BEAVER (1970) mention the structure of the penis, in addition to other characters, as a distinguishing character of the species discussed by them. The employment of anatomical structure complicates the identification of individual specimens, but in some cases it appears to be necessary. The preparation of a set of drawings, presenting copulatory organs, seems to be indispensable for a correct identification of some doubtful specimens. From the material available to us we have made preparations and drawings of penis of *H. ater* PAYK., *H. brunneus* ER., *H. cunicularius* ER., *H. opacus* ER., *H. angustatus* HERBST and *H. attenuatus* ER.

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Methods of studies

The material for the studies was collected in the Experimental Forestry Zielonka near Poznań, in the Forestries Krobielewko (Puszcza Nadnotecka) and Wilkanowo near Zielona Góra in the period between April 4, 1973 and June 28, 1973.

Besides the material collected by the authors, they used materials from:

1. the BAKKE collection	— <i>H. brunneus</i> ER.	30 specimens
	— <i>H. cunicularius</i> ER.	13 "
	— <i>H. attenuatus</i> ER.	4 "
	— <i>H. opacus</i> ER.	4 "
2. the LEKANDER collection	— <i>H. brunneus</i> ER.	52 specimens
	— <i>H. opacus</i> ER.	52 "
	— <i>H. cunicularius</i> ER.	52 "
3. the LINDEMANN collection	— <i>H. ater</i> PAYK. ¹	1 specimen
4. the NUNBERG collection	— <i>H. brunneus</i> ER.	5 specimens
5. the PAMPUCH collection	— <i>H. ater</i> PAYK.	48 specimens
	— <i>H. attenuatus</i> ER.	3 "
	— <i>H. angustatus</i> HERBST	17 "
	— <i>H. opacus</i> ER.	19 "
6. the PFEFFER collection	— <i>H. ater</i> PAYK.	3 specimens
	— <i>H. aterrimus</i> EGG.	15 "
	— <i>H. cunicularius</i> ER.	16 "
	— <i>H. rotundicollis</i> REITT.	14 "
7. the SZYCHOWIAK collection	— <i>H. cunicularius</i> ER.	12 specimens

The material collected by the authors was stored in a 70% ethyl alcohol². The specimens were collected from pine rolls, logging residues and horizontal pine trunks after thinning. Copulating pairs were put into separate test-tubes. Each specimen was labeled with a succeeding number, which excluded the possibility for a specimen to be described twice. Most specimens were examined in respect of morphology, the following characters being taken into consideration:

a) measurable: the height of the carina, the pronotal length and breadth, the length of the median line on the pronotum, the elytral length and breadth, the breadth of the first three interstices and striae in the middle of the elytral length, measurements of the 5th abdominal sternite, the length of the median thorax line

b) unmeasurable: fovea above the clypeus, pubescence and punctation of the frons, punctation of the pronotum, rugosities, punctation and the anterior margin of the elytra, the shape, set and punctation of the scutellum, pubescence of the elytral truncature, the shape, pubescence, punctation of the 5th abdominal sternite, punctation of the 1st abdominal sternite, punctation and pubescence of the thorax.

¹ V. N. STARK placed LINDEMANN's specimen in specimens of *H. aterrimus* EGG.

² Transportation and storage in alcohol permit to avoid wearing out of hairs and scales.

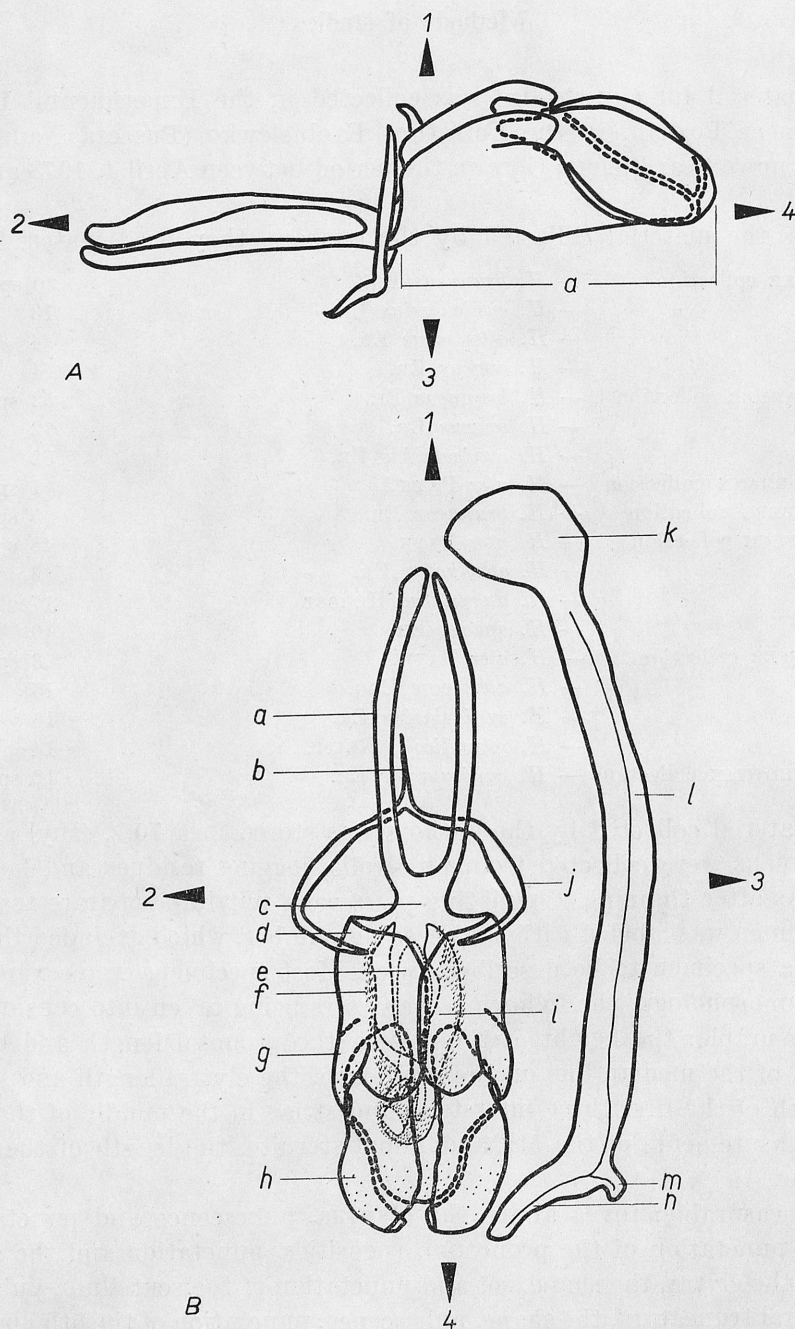


Fig. 1. Penis — in natural position, close to that it occupies in the abdomen of an insect
 Пенис — естественное положение, близкое к тому, в котором он находится в брюшке насекомого
 Penis — układ naturalny, zbliżony do tego, jaki zajmuje on w odwłoku owada

A. Lateral view — вид сбоку — widok z boku; 1. dorsal side — дорсальная сторона — strona grzbietowa, 2. front — перед — przód, 3. ventral view — брюшная сторона — strona brzuszna, 4. back — задняя часть — tył, a. the median lobe — корпус — korpus. B. Dorsal

The authors tried to embrace all distinguishing characters of species, accepted in the available keys and, as it may be inferred from the above lists of characters; they also tried to take into consideration other characters, which might be useful in identification. All mentioned above characters were recorded in a special register book. Measurements and analyses of morphological characters were made by a stereoscopic microscope MBS — 1 at $32\times$ magnification. Measuring was performed by a micrometer (one point = 0.025 mm) and drawings were made by the use of a square grid (one side of the square = 0.1 mm). With the aim to obtain qualitatively similar results of measurements and observations with reference to different morphological characters, the position and illumination of specimens was constant ¹. The measurement of the length and breadth of the pronotum (at the broadest place) and elytra (0.5 mm from their base) and the measurement of the length of the pronotal median line were made when specimens were in a horizontal position and the illumination was directed backwards. The sculpture of the interstices and the pubescence of the elytral truncature were observed when the illumination was directed towards the front, because in such illumination the elytral sculpture was most suitably exposed. The measurements and observations of morphological characters of the abdominal side of the specimen body were made in the illumination directed backwards, the specimens being in a horizontal position. The measurement of the carina height was made when specimens were in a vertical position and were illuminated from the side.

After a morphological analysis the specimens were stored in a dry state, each of them being kept in a separate test-tube.

Studies of anatomy concerned the structure of the male copulatory apparatus. To make individual specimens ready for preparation, they were boiled in 5—7% KOH for 15—20 minutes and later in H₂O for 10—20 minutes. Differences in the concentration of KOH and in the time of boiling depended on the degree of specimens dryness ². The elements required were prepared under a stereoscopic microscope MSt-130 and placed in FAURE'S fluid on the wellslide with a handing drop. The obtaining of a true picture of the penis depends, according to the authors, on the position of the preparation. In the present paper the authors

¹ Luminous rays fall down at an angle of 60° in relation to the stage of the microscope.

² Specimens from earlier collections were boiled longer and at a higher concentration of KOH.

view — вид сверху — widok z góry: 1. front — перед — przód, 2. left side — левый бок — lewy bok, 3. right side — правый бок — prawy bok, 4. back — задняя часть — tył, a. median struts — ножки (отростки) — nóżki, b. tegmenal strut — отросток ушка — znamię uszka, c. clasp — зажим — klamra, d. tops of median lobe — вершины коргуса — szczyty korpusu, e. seminal trough — дуктус — rynienka, f. internal sac — семенной мешок — pokrowiec, g. lateral lobes — боковые пластинки — płyty boczne, h. protrudent lobes — отстающие пластинки — płyty odcięte, i. dorsal lobes — дорсальные пластинки — płyty grzbietowe, j. tegmen — ушко — uszko, k. blade of spiculum — лопатка спикулум — łopatką szpikulca, l. spiculum gastrale — стребелек — szpikulec, m. process of spiculum gastrale — бугорок стебелька — wyrostek szpikulca, n. foot — стопа — stopa

accepted the natural position of the penis close to that it occupies in the abdomen of the pest (Fig. 1). Special attention was given to the structure of the median lobes, median struts and tegmen. The external structure is marked schematically not to darken the most important characters. The descriptions are supplemented with a new terminology accepted by the authors with the aim to emphasize the importance of certain elements of the penis in the determination of species.

Drawings were made with the use of a stereoscopic microscope MSt-130 with a square grid at magnification $48\times$ (one side of the square = 0.125 mm). Details were analysed under a biological microscope MB-1 at magnification from 50 to $600\times$. In all, 67 penis preparations were made.

The best insects and preparations are in the authors' collection in the Institute of Forest Protection, Academy of Agriculture, in Poznań.

Table I

Biometrical data for the species under study

No. of specimens	Species	Sex	Pronotal index		Elytral index		Total length (mm)*	
			range	mean	range	mean	range	mean
250	<i>H. ater</i> PAYK.	♂♂	1.11—1.29	1.20	1.61—2.04	1.83	3.40—4.63	4.08
250		♀♀	1.09—1.35	1.22	1.70—2.00	1.87	3.65—5.00	4.36
15	<i>H. brunneus</i> ER.	♂♂	1.08—1.19	1.14	1.75—1.87	1.81	3.55—4.13	3.95
15		♀♀	1.13—1.19	1.16	1.78—1.92	1.85	3.97—4.55	4.34
7	<i>H. cunicularius</i> ER.	♂♂	0.98—1.15	1.06	1.46—1.76	1.62	3.52—4.23	3.83
7		♀♀	0.94—1.10	1.05	1.57—1.73	1.67	3.82—4.38	4.10
15	<i>H. opacus</i> ER.	♂♂	0.97—1.10	1.02	1.56—1.80	1.68	2.40—3.00	2.76
15		♀♀	0.93—1.10	1.03	1.60—1.77	1.67	2.77—3.13	2.95
2	<i>H. attenuatus</i> ER.	♂♂	1.06—1.07	1.065	1.63—1.92	1.77	2.24—2.65	2.44
5		♀♀	1.03—1.12	1.06	1.74—1.82	1.78	2.32—2.63	2.51
2	<i>H. angustatus</i> HER ST	♂♂	1.06—1.09	1.075	1.75—1.82	1.78	2.57—2.68	2.62
2		♀♀	1.05—1.08	1.065	1.79—1.83	1.81	2.90—2.93	2.92

* Total length is the sum of the pronotal and elytral lengths.

Discussion of results

On the basis of measurements of the length and breadth of the pronotum and elytra, the pronotal and elytral indices have been estimated for each sex

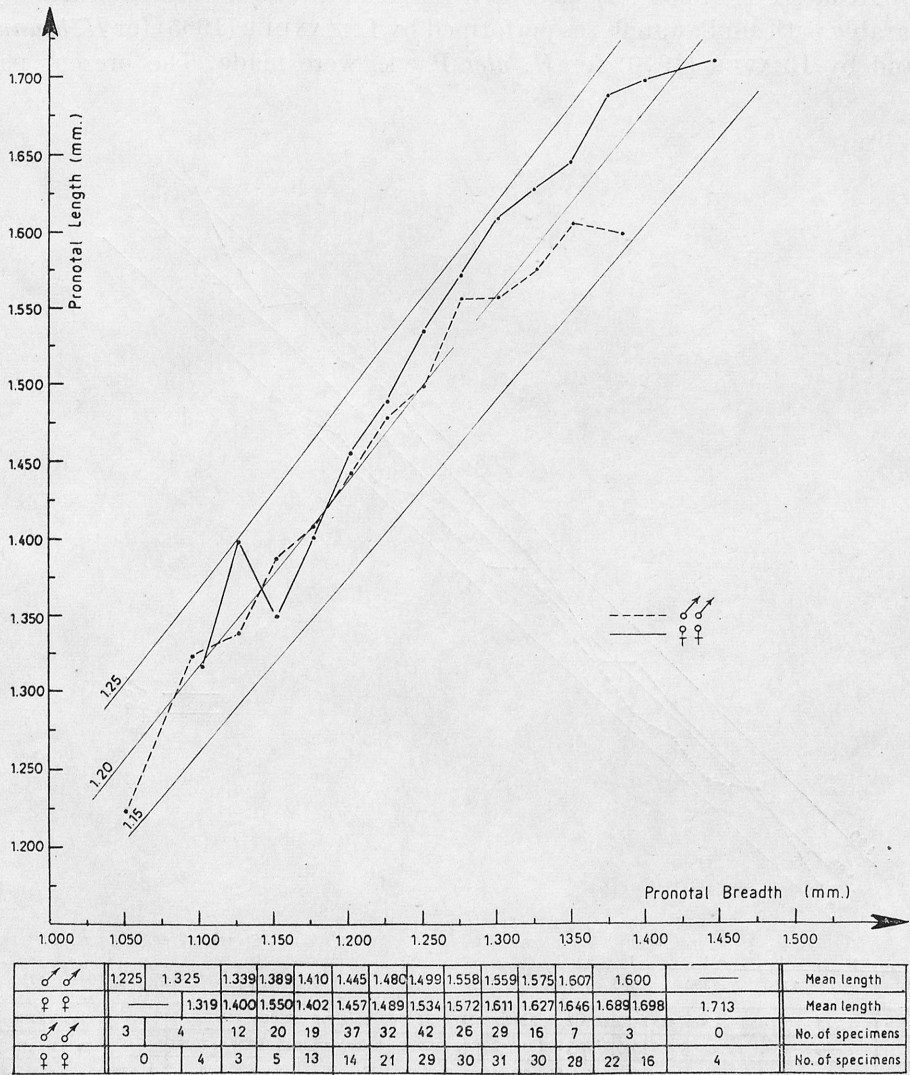


Fig. 2. Correlation between the pronotal length and breadth in *H. ater* ПАУК. (Below the diagram there are numbers and means of the pronotal length of males and females in different degrees of breadth)

Зависимость между длиной и шириной переднеспинки у *H. ater* ПАУК.. (Под диаграммой помещены численность и средние длины переднеспинки самцов и самок в различных степенях ширины)

Zależność między długością a szerokością przedplecza u *H. ater* ПАУК. (pod wykresem umieszczono liczebność i średnie długości przedplecza samców i samic w poszczególnych stopniach szerokości)

of the species under study. For the reason the number of measurements for *H. brunneus* ER., *H. cunicularius* ER., *H. opacus* ER., *H. angustatus* HERBST, *H. attenuatus* ER. was insufficient, we have given only the mean and extreme values of indices, which constitute variability of the mentioned species. (Table I).

For *H. ater* PAYK. 250 measurements of each sex and a mathematic analysis comparable with similar analyses performed by LEKANDER (1965) for *H. brunneus* ER. and by BEAVER (1970) for *H. ater* PAYK. were made. The present paper

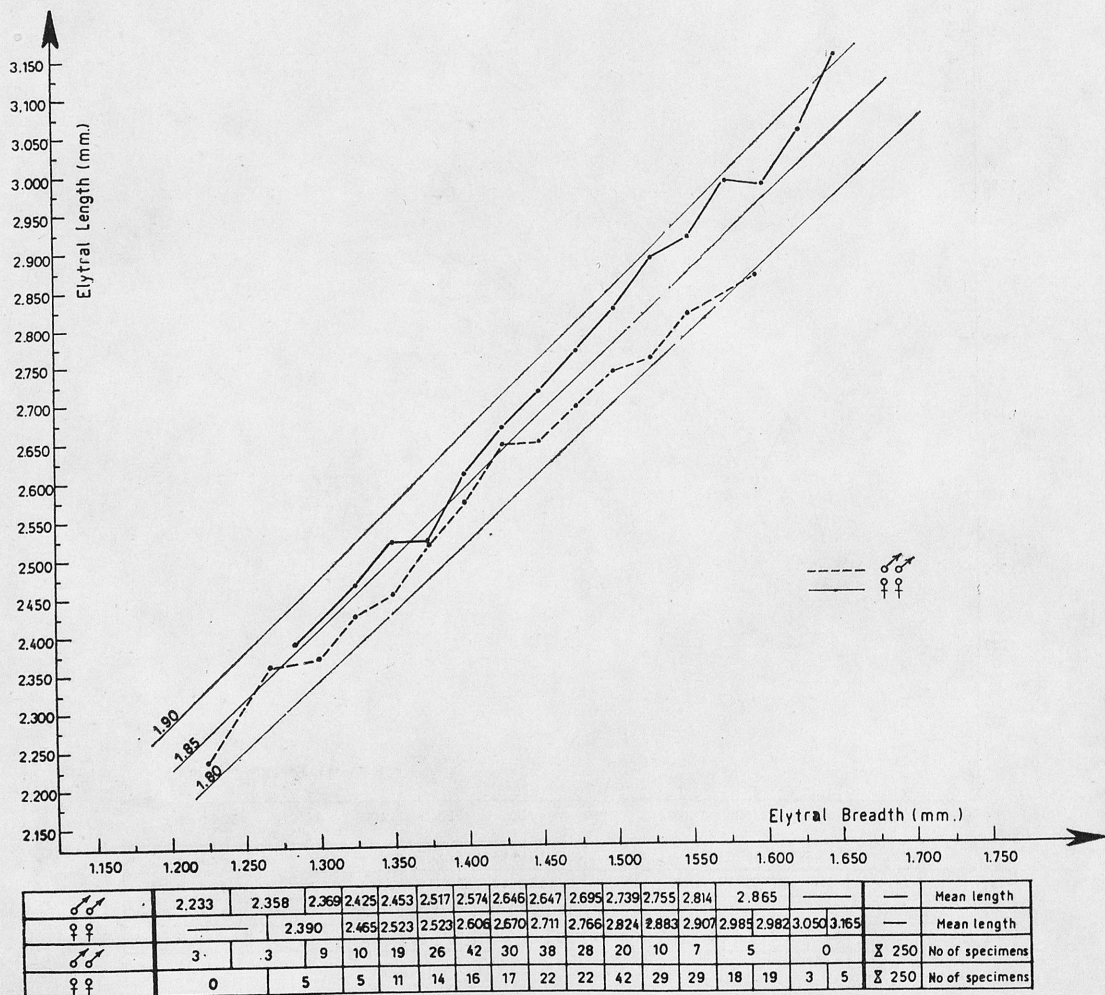


Fig. 3. Correlation between the elytral length and breadth in *H. ater* PAYK. (Below the diagram there are numbers and means of the elytral length of males and females in different degrees of breadth)

Зависимость между длиной и шириной надкрылий у *H. ater* PAYK. (Под диаграммой помещены численность и средние длины надкрылий самцов и самок в различных степенях ширины)

Zależność między długością a szerokością pokryw u *H. ater* PAYK. (pod wykresem umieszczono liczebności i średnie długości pokryw samców i samic w poszczególnych stopniach szerokości)

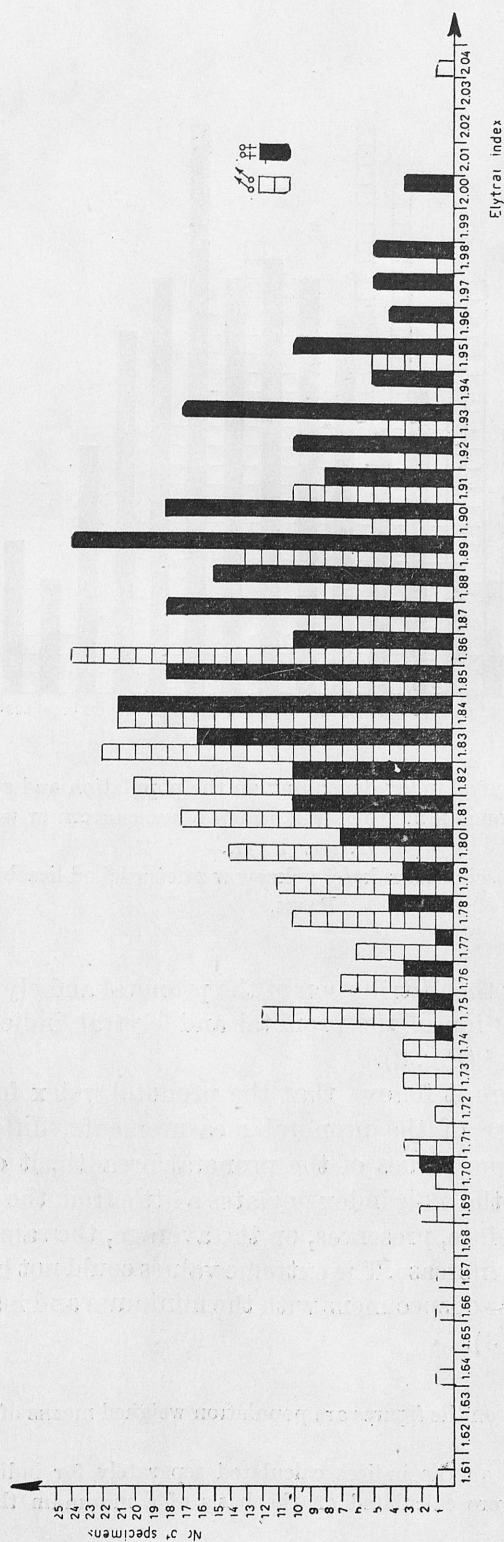


Fig. 4. Distribution of the pronotal index depending on the population and sex of *H. ater* PAUK. Rozkład współczynnika długości do szerokości przedplecza w zależności od liczebności i płci u *H. ater* PAUK.

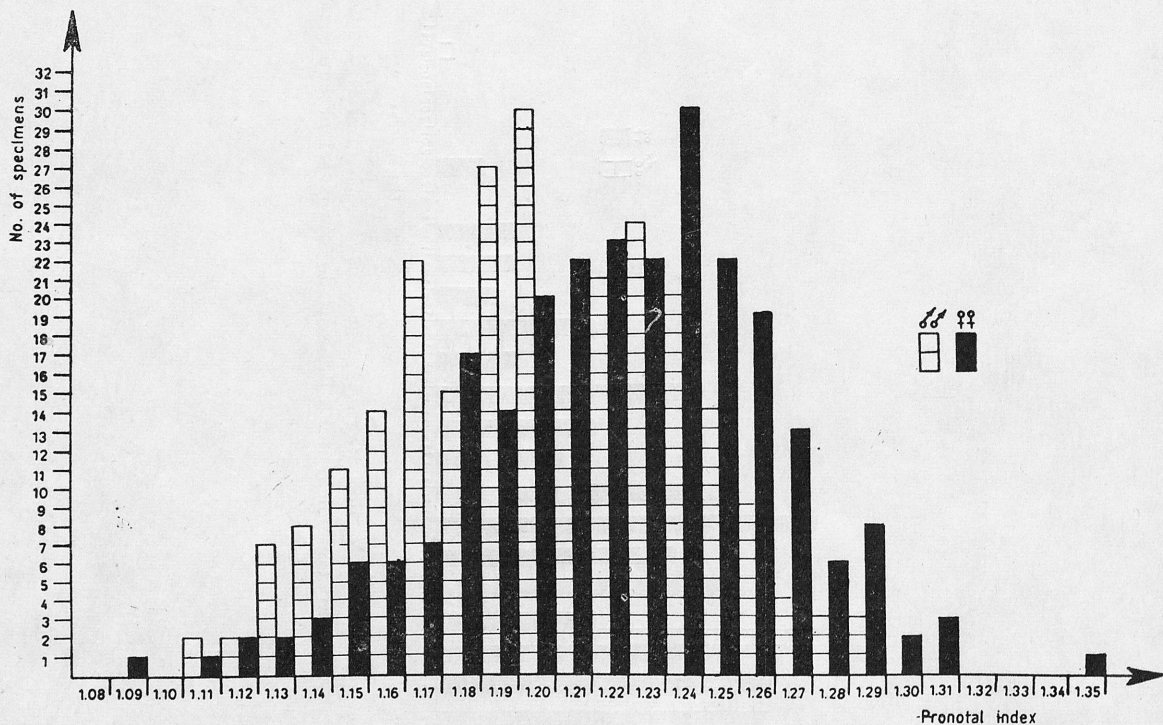


Fig. 5. Distribution of the elytral index depending on the population and sex of *H. ater* PAYK.
 Разложение коэффициента длины к ширине надкрылий в зависимости от численности и пола у
H. ater PAYK.

Rozkład współczynnika długości do szerokości pokryw w zależności od liczebności i płci u *H. ater* PAYK.

contains figures showing the distribution of the pronotal and elytral indices ¹ and figures with the distribution of the pronotal and elytral indices depending on the population and sex ² (Fig. 2).

From the above figure it follows that the pronotal index for *H. ater* PAYK. changes with an increase of the pronotal measurements, differently for each sex. Omitting the extreme values of the pronotal breadth, it can be seen that the curve characterizing the male index deviates a little from the line representing the value 1.20 and, therefore, preserves, on the average, the same value, whereas the female index tends to increase. The extreme values could not be presented here because of a small number of specimens with the minimum and maximum breadth of the pronotum ³ (Fig. 3).

¹ The ordinates of points on the figures are population weighed means of lengths in different degrees of breadth.

² The figures are based on the indices calculated separately for individual species.

³ The extreme values were calculated on the basis of a minimum three measurements, using the weighed mean.

It is seen from Fig. 3 that the curves characterizing the distribution of the elytral indices run differently for each sex. The mean male indices range from about 1.80 to about 1.86, whereas the mean female indices range from about 1.86 to about 1.91. There is a similarity between the curves showing the distribution of the pronotal and elytral indices for both sexes of *H. ater* PAYK. (Fig. 4).

In case of males the pronotal index ranges between 1.11 and 1.29, while in case of females it ranges between 1.09 and 1.35. In the distribution of the same index in relation to males as if there were two peaks. The distribution of this index is more regular in females, although its range is considerably wider (Fig. 5).

The ratio of the elytral length to breadth in *H. ater* PAYK. ranges very widely, between 1.61—2.04 in males and between 1.70—2.00 in females. That index with such a wide range cannot be a characteristic feature of the discussed species.

Of interest is also the analysis of the shape of the pronotum and its variability (Fig. 6).

Various shapes of the pronotum, presented in the mentioned figure, constitute the pronotum variation within the species and sex. That variation excludes the determination of sex in all discussed species of bast bark beetles. It is impossible either to identify for certain all specimens of *H. ater* PAYK. and *H. brunneus* ER. on the basis of the shape of the pronotum.

The analysis of the length and form of the median pronotal line in the discussed species showed that there is no distinct correlation between that character and the species. Only specimens of *H. cunicularius* ER. from the group of large bast bark beetles have a slightly raised median line⁴, which in connection with a characteristic, anteriorly constricted pronotum constitutes a certain diagnostic feature of the mentioned species. In the group of small bast bark beetles no correlation was found between the form and length of the median line and the species.

The authors found no relationship either between the scutellum shape and the species (Fig. 7).

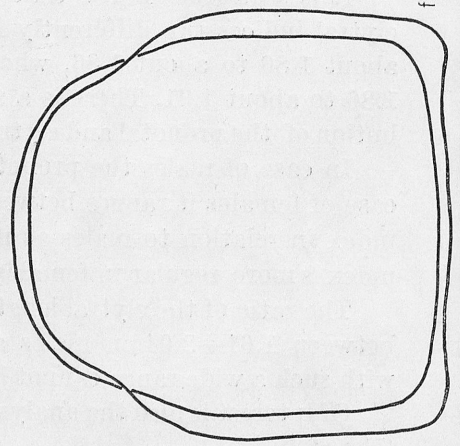
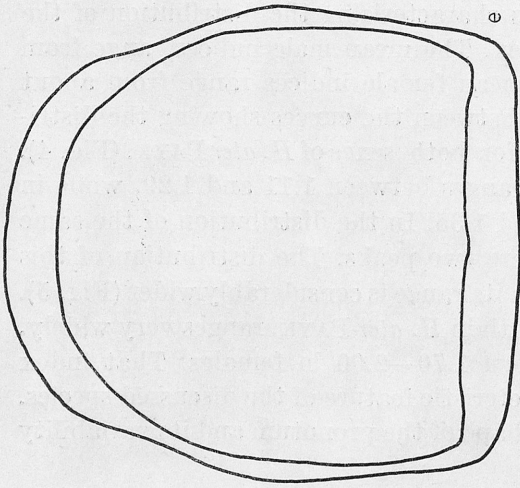
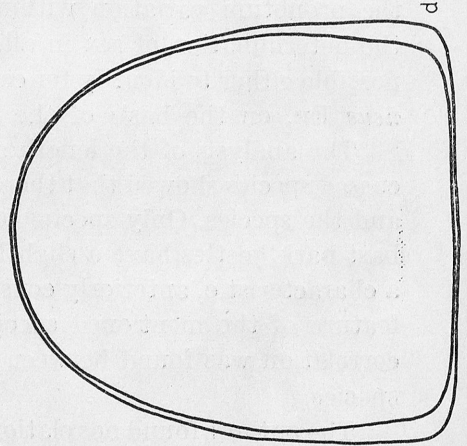
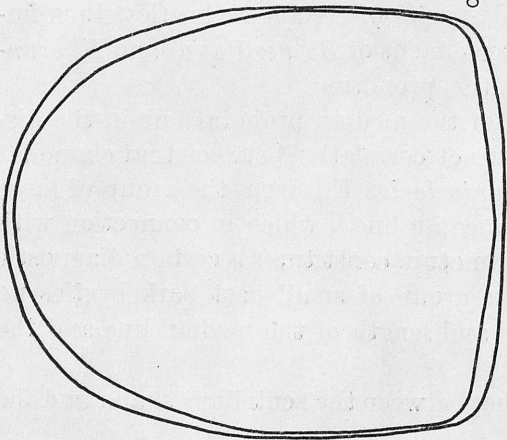
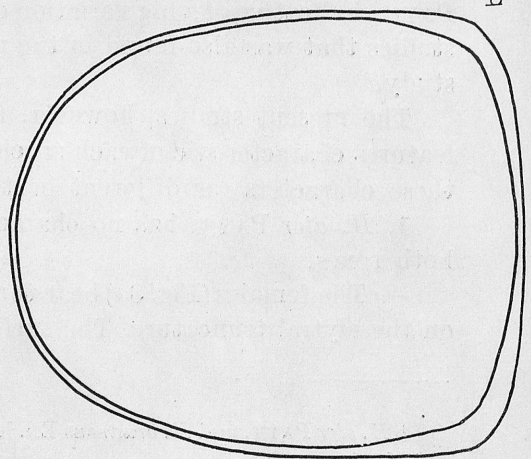
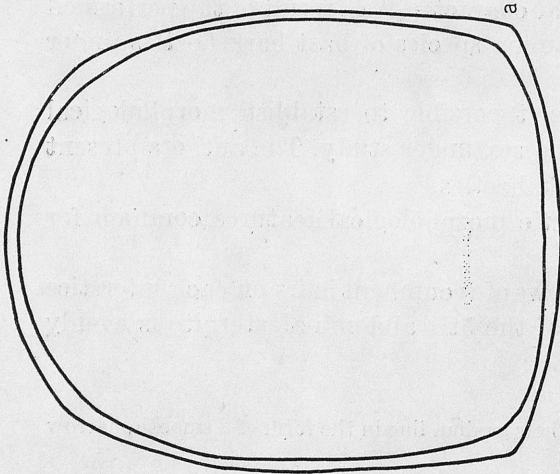
The above drawings present several shapes of the scutellum of *H. ater* PAYK., indicative of a big variation of that character. As a result of the performed studies that was also found in the remaining species of bast bark beetles under study.

The present studies, however, made it possible to establish morphological features characteristic of each species and sex under study. The authors present these characters for different bast bark beetles.

1. *H. ater* PAYK. has no characteristic morphological features common for both sexes.

— The females (Fig. 8a) bear three rows of recumbent hairs on each interstice on the elytral truncature. The surface of the 5th abdominal sternite is evenly

⁴ *H. ater* PAYK. and *H. brunneus* ER. have their median line in the form of a smooth, narrow and shining surface.



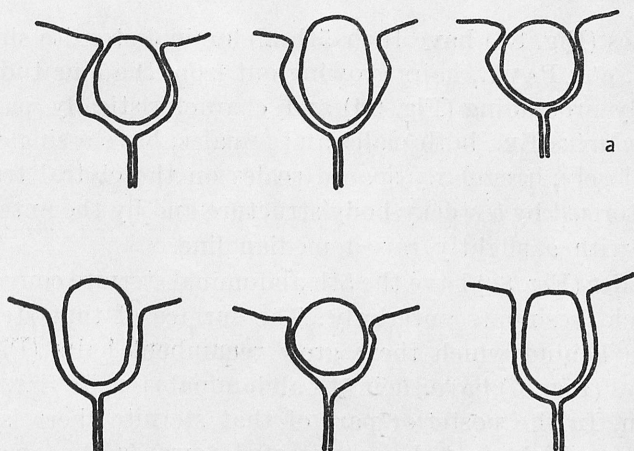


Fig. 7. Examples of variation in the shape of scutellum in *H. ater* PAYK.; a) — females, b) — males

Примеры изменчивости формы щитка у *H. ater* PAYK.; а) самки, б) самцы
Przykłady zmienności kształtu tarczki u *H. ater* PAYK.; a — samice, b — samce

convex (Fig. 9a) and is covered with pits, from behind which there are recumbent hairs. The anterior margin of that sternite is anteriorly sinuate (Fig. 10a).

— The males (Fig. 8b) have a single row of protruding hairs and irregularly spaced recumbent scales on each interstice of the elytral truncature. In the posterior part of the 5th abdominal sternite there is a longitudinal impression with long, recumbent (Fig. 9c), radially arranged hairs (Fig. 10b). The surface of the 5th abdominal sternite is flat, except the mentioned impression, and covered, like in the females, with pits, from behind which there appear recumbent hairs; the anterior margin of that sternite is straight.

2. *H. brunneus* ER. has a single row of protruding hairs on each interstice on the elytral truncature and irregularly spaced, recumbent scales in both sexes.

— The females (Fig. 8c) have their 5th abdominal sternite with a flat surface in the apical part, concaving towards the anterior margin (Fig. 9b) which also distinguishes them from the females of *H. ater* PAYK. The 5th sternite is with pits, from behind which there are recumbent hairs. In the posterior flat part of that sternite pits are smaller and more closely spaced (Fig. 10c).

Fig. 6. Examples of the pronotal variation a) — females of *H. ater* PAYK., b) males of *H. ater* PAYK., c) — females of *H. brunneus* ER., d) males of *H. brunneus* ER., e) — females of *H. cunicularius* ER., f) males of *H. cunicularius* ER.

Примеры изменчивости переднеспинки; а) — самки *H. ater* PAYK., б) — самцы *H. ater* PAYK.,
с) — самки *H. brunneus* ER., d) — самцы *H. brunneus* ER., е) — самки *H. cunicularius* ER.
f) — самцы *H. cunicularius* ER.

Przykłady zmienności przedplecza а) — samice *H. ater* PAYK., б) samce *H. ater* PAYK., с) —
samice *H. brunneus* ER., d) samce *H. brunneus* ER., е) — samice *H. cunicularius* ER., f) samce
H. cunicularius ER.

— The males (Fig. 8d) have their 5th abdominal sternite similar to that of the males of *H. ater* PAYK., hairs growing out from the longitudinal impression being irregularly protruding (Fig. 9d) and characteristically parted (Fig. 10d).

3. *H. cunicularius* ER., both males and females, have a single row of protruding hairs and closely, irregularly spaced scales on the elytral truncature. They are also characterized by a stocky body structure and by the anteriorly constricted pronotum with a slightly raised median line.

— The females (Fig. 8e) have the 5th abdominal sternite convex, the anterior margin of which is sinuate anteriorly. The surface of that sternite is covered with pits, from behind which there grow recumbent hairs (Fig. 10e).

— The males (Fig. 8f) have their 5th abdominal sternite flat, with a straight anterior margin. In the posterior part of that sternite there is a longitudinal impression, from which erect hairs, directed towards the apex, are growing (Fig. 10f). The remaining part of the 5th abdominal sternite surface is covered with pits, from behind which there grow recumbent hairs.

In the group of small bast bark beetles (*H. angustatus* HERBST, *H. attenuatus* ER., *H. opacus* ER.) the determination of sex can be based only on differences in the shape of the 5th abdominal sternite. In the females that sternite is more convex than in the males. The anterior margin of the 5th sternite is anteriorly sinuate in the females and straight in the males.

4. *H. angustatus* HERBST (Figs. 8g, 8h) has a single row of hairs growing out of very small tubercles over the entire length of the first interstice. On the remaining interstices hairs are arranged in two rows, whereas on the elytral truncature there is a single visible row of protruding hairs.

5. *H. attenuatus* ER. (Figs. 8i, 8j) is characterized by a single row of protruding hairs on each interstice from the base to the apex of the elytra. Hairs in the elytral posterior part grow out from small tubercles.

6. *H. opacus* ER. (Figs. 8k, 8l) has a single row of hairs on the first interstice and two rows on each of the remaining interstices. On the elytral truncature hairs grow out from small tubercles; they are protruding and arranged in a single row on each interstice. This species is characterized by a stocky structure of the body.

Among measurable and unmeasurable characters, analysed in the course of the present studies, there are also such ones, which cannot be recognized as characteristic of different species and sexes: the height of the carina, the breadth of the first three striae and interstices, the size of the 5th abdominal sternite, the length of the median line of the thorax, fovea above the clypeus, pubescence and punctation of the frons, punctation of the pronotum, rugosities, punctation and the anterior margin of the elytra, the shape, set and punctation of the scutellum, punctation of the 1st abdominal sternite and punctation and pubescence of the thorax.

Anatomical studies confirmed the correctness of the identification of different male specimens on the basis of morphological characters recognized by the authors as distinguishing ones. This distinctly indicates the suitability of these

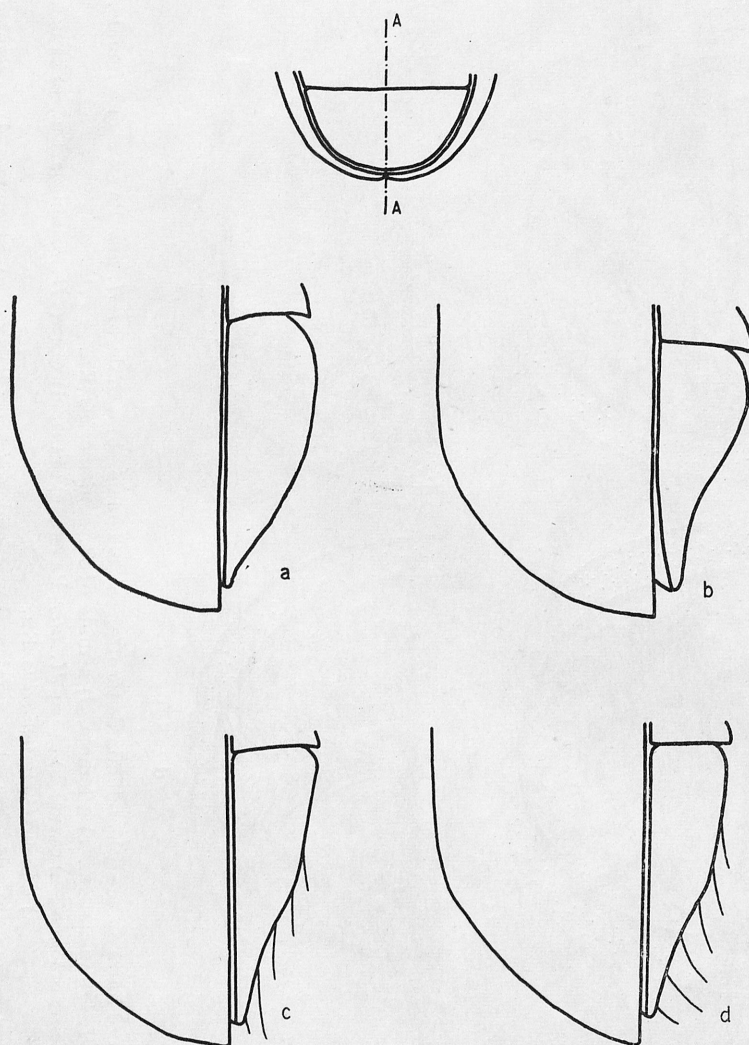


Fig. 9. A schematic picture of the cross-section of the 5th abdominal sternite; a) a female of *H. ater* PAYK., b) a female of *H. brunneus* ER., c) a male of *H. ater* PAYK., d) a male of *H. brunneus* ER.

Схематический образ разреза 5-го сегмента брюшка; а) самка *H. ater* PAYK., б) самка *H. brunneus* ER., в) самец *H. ater* PAYK., д) самец *H. brunneus* ER.

Schematyczny obraz przekroju piątego segmentu odwłoka; а) — samica *H. ater* PAYK., б) — samica *H. brunneus* ER., в) — samiec *H. ater* PAYK., д) — samiec *H. brunneus* ER.

characters for correct identification. On the other hand, the preparations made it possible to establish and separate characters of the penis structure for each species under study.

1. *H. ater* PAYK. (Figs. 11a, b, c)

The median lobe is cylindrical, with a characteristic step-like bend in the mid-length on the abdominal sides. Lateral tops of the median lobe are slightly

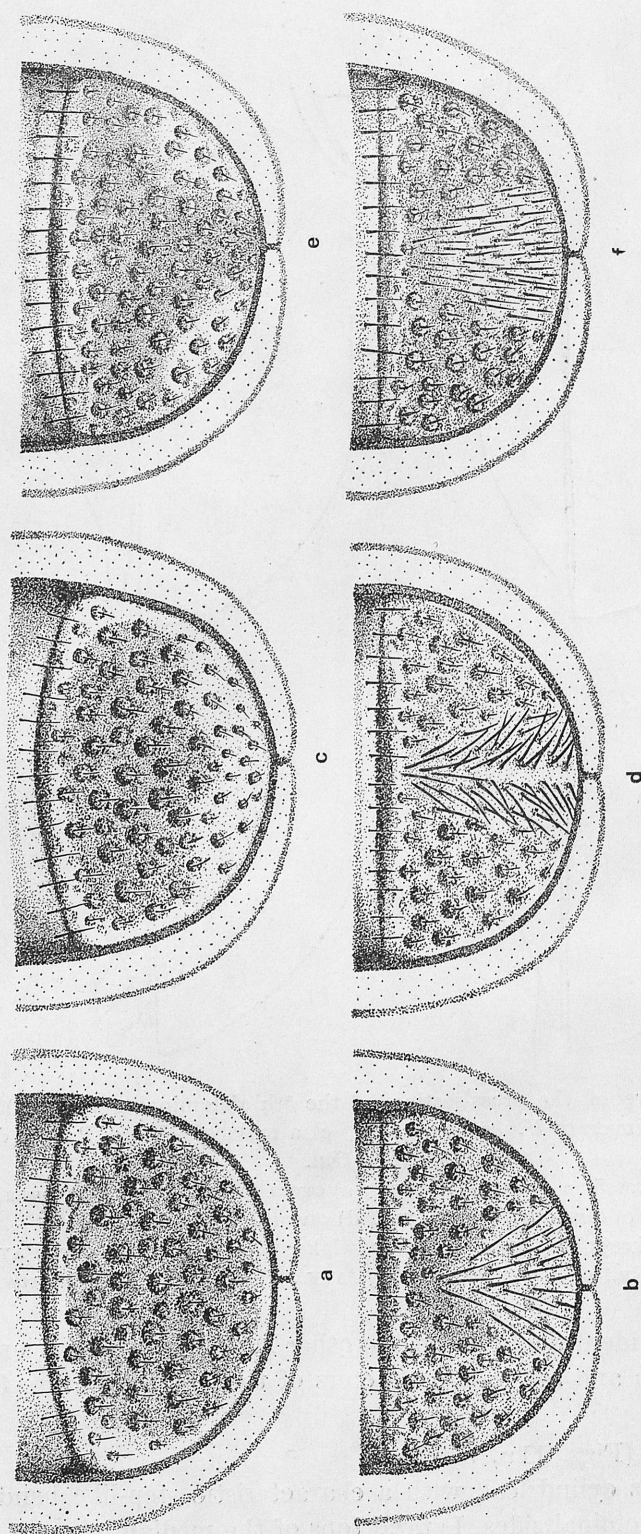


Fig. 10. A scheme of the arrangement of pits and hairs on the 5th abdominal sternite; a) a female, b) a male of *H. ater* PAUK., c) a female, d) a male of *H. brunneus* ER., e) a female, f) a male of *H. cunicularius* ER.

Схема уложения ямок и волосков на 5-ом сегменте брюшка; а) самка, б) самец *H. ater* PAUK., c) самка, d) самец *H. brunneus* ER., e) самка, f) самец *H. cunicularius* ER.

Schemat układu dołków i włosków na piątym segmencie odwłoka; a) — samica, b) — samiec *H. ater* PAUK., c) — samica, d) — samiec *H. brunneus* ER., e) — samica, f) — samiec *H. cunicularius* ER.

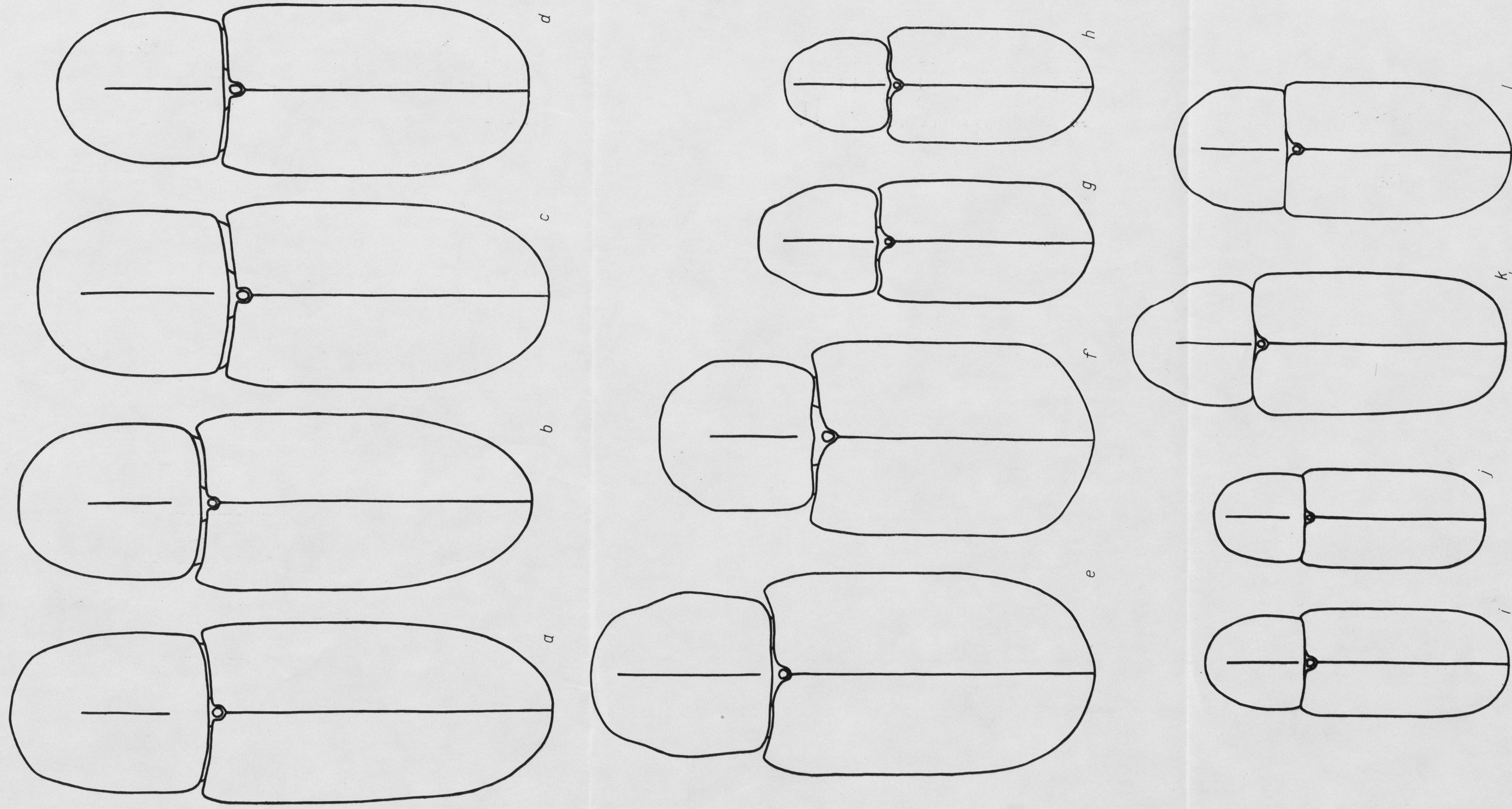


Fig. 8. The shape of the studied species of bark beetles; a) — females, b) — male of *H. ater* PAYK., c) — females, d) — male of *H. brunneus* ER., e) — females, f) — male of *H. cunicularius* ER., g) — females, h) — male of *H. angustatus* HERBST, i) — females, j) — male of *H. attenuatus* ER., k) — females, l) — male of *H. opacus* ER.

Очертание формы исследованных видов короедов; а) — самка, б) — самец *H. ater* ПАУК., в) — самка, д) — самец *H. brunneus* ЭР., е) — самка, ф) — самец *H. cunicularius* ЭР., г) — самка, h) — самец *H. angustatus* ГЕРБСТ, и) — самка, j) — самец *H. attenuatus* ЭР., k) — самка, л) — самец *H. opacus* ЭР.

Рисункі kształtu badanych gatunków zakorków; a) — samica, b) — samiec *H. ater* ПАУК., в) — samica, d) — samiec *H. brunneus* ЭР., е) — samica, f) — samiec *H. cunicularius* ЭР., г) — samica, h) — samiec *H. angustatus* ГЕРБСТ, и) — samica, j) — samiec *H. attenuatus* ЭР., k) — samica, л) — samiec *H. opacus* ЭР.

stretched frontwards. Protrudent lobes are large, noticeably widely spaced. Dorsal lobes are somewhat longer than the half-length of the median lobe; they are arcuately ended in their posterior part and slightly overlapping. Lateral, poorly-defined lobes do not attain the mid-length of the dorsal lobes. The clasp is rather broad than long. The tegmen is considerably longer in diameter than the median lobe, with a long, pointed strut. The tops of the tegmen are narrow, pointed. The internal sac is clearly seen from the abdominal side; it is long, finely burred, especially at the outlet of the seminal trough, and is clearly seen in the posterior part of the median lobe.

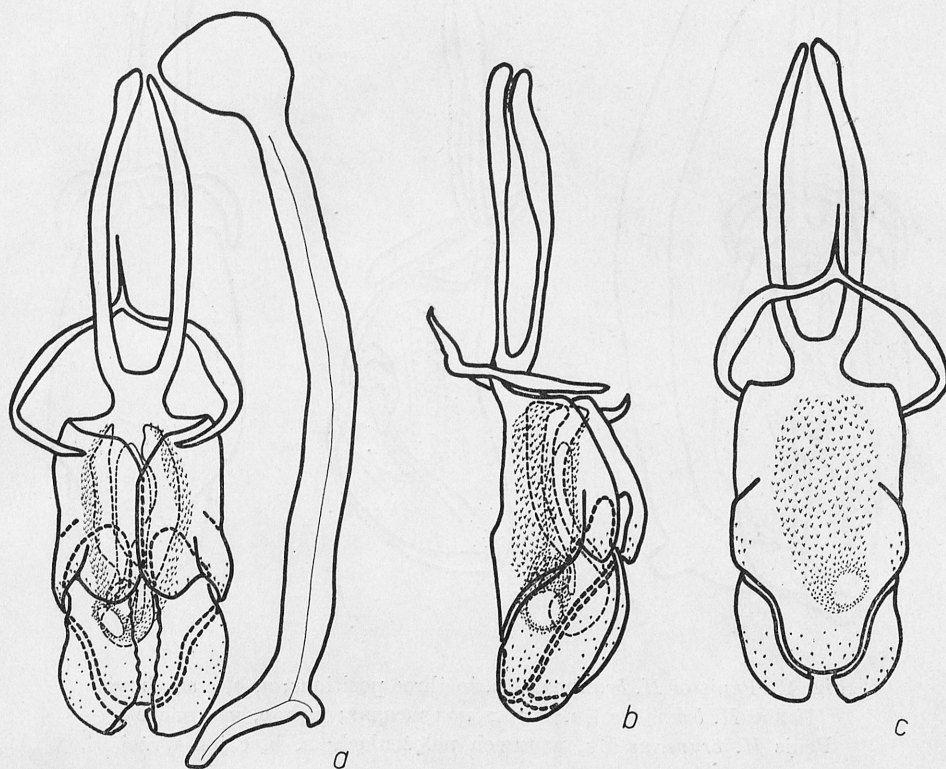


Fig. 11. Penis of *H. ater* PAYK. in three positions; a) viewed from the dorsal side, b) viewed from the side, c) viewed from the abdominal side

Пенис *H. ater* PAYK. в трех положениях; а) вид с дорсальной стороны, б) вид с брюшной стороны, в) вид сбоку

Penis *H. ater* PAYK. w trzech położeniach; a) — widok od strony grzbietowej, b) — widok z boku, c) — widok od strony brzusznej

2. *H. brunneus* ER. (Figs. 12a, b, c)

The median lobe is strongly narrowed in the apical part. Lateral tops of the median lobe are strongly stretched frontwards. Protrudent lobes are asymmetrical (the right one is more bulged). Dorsal lobes are slightly longer than half of the median lobe length; they have a straight posterior margin and do not overlap.

The clasp is elongate, sometimes medially narrowed. The tegmen is nearly equal to the median lobe in diameter; it is broad at the ends and flattened. The tegmenal strut is not too long and is obtuse on the top. The internal sac is big, covered with large burrs, which become very small at the outlet of the seminal trough.

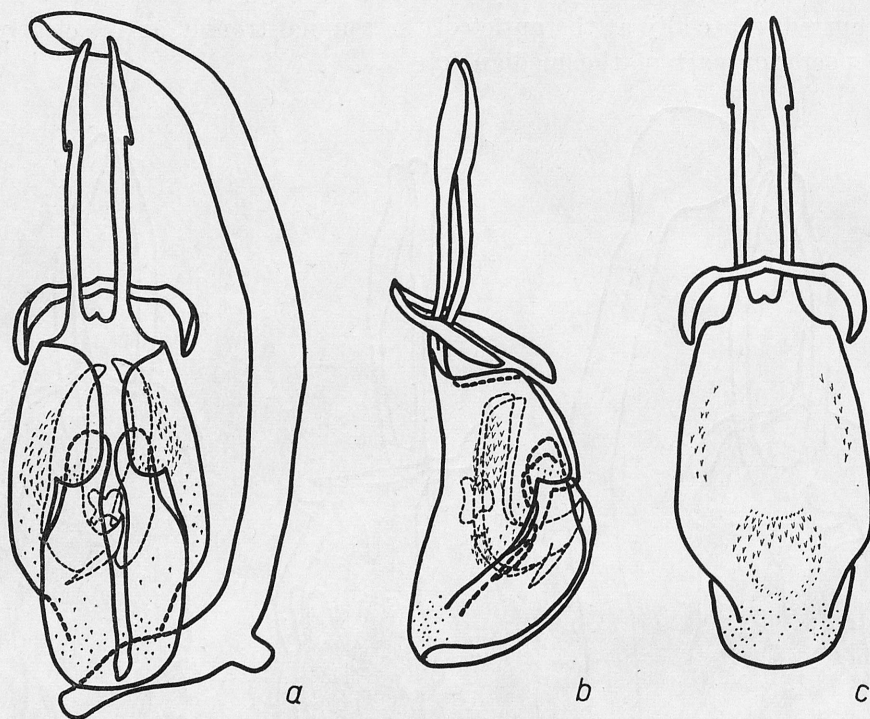


Fig. 12. Penis of *H. brunneus* ER. in three positions; a, b, c as above
 Пенис *H. brunneus* ER. в трех положениях; а, b, c, как выше
 Penis *H. brunneus* ER. w trzech położeniach; a, b, c jak wyżej

3. *H. cunicularius* ER. (Figs. 13a b, c)

The median lobe is spindle-like, lateral tops are gently sloping. Protrudent lobes are not completely separate from the median lobe. Dorsal lobes are shorter than half of the median lobe length; they are narrow, considerably spaced, their posterior margin is arcuate, sometimes gently converting to a lateral lobe. The clasp is broad and short, elongated between the median struts into a short, acute process. The tegmen is smaller than the median lobe in diameter; it is flattened on the ends and has traces of the tegmenal strut. The internal sac is vestigial, it is defined at the lateral lobes and at the outlet of the seminal trough; it is covered with long, acute burrs.

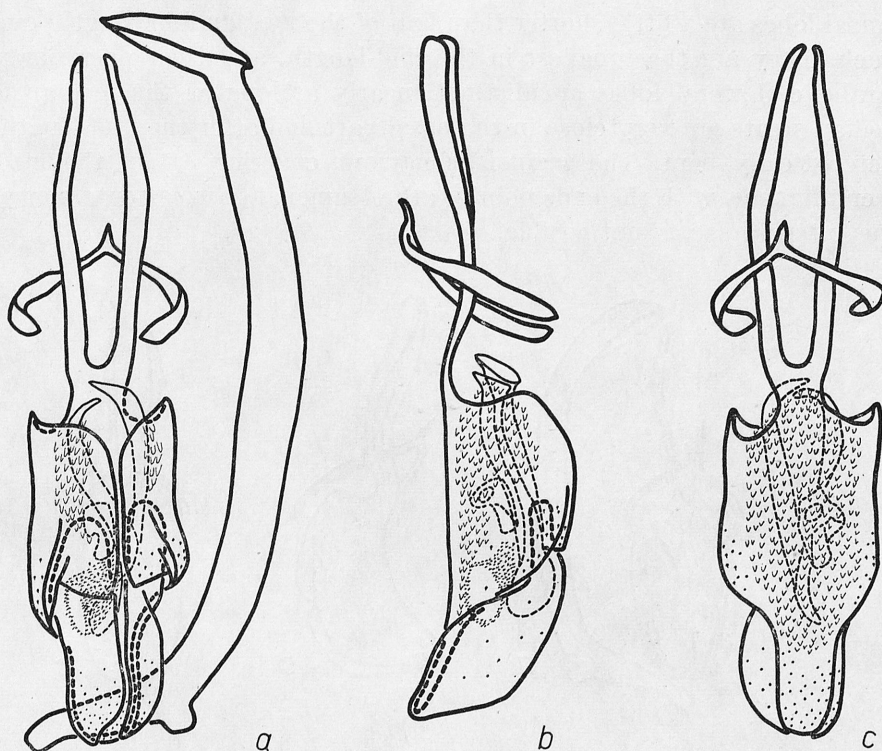


Fig. 13. Penis of *H. cunicularius* ER. in three positions; a, b, c as above
 Пенис *H. cunicularius* ER. в трех положениях; а, b, c, как выше
 Penis *H. cunicularius* ER. w trzech położeniach; a, b, c jak wyżej

4. *H. angustatus* HERBST (Figs. 14a, b, c)

The median lobe is barrel-like, the lateral tops are slightly raised. The posterior margin of the median lobe is straight. Protrudent lobes are completely separate from the median lobe (placed inside the median lobe, bulged in their mid-length). Dorsal lobes are insignificantly longer than half of the median lobe, widened backwards and arcuately ended. Sometimes they are slightly overlapping. The external margins of a protrudent and dorsal lobes are recumbent on their entire length to the external margin of the lateral lobes. Lateral lobes are distinct, nearly as long as the median lobe. The clasp is reduced much. The tegmen is narrow, embracing $2/3$ of the median lobe circumference, with a short, pointed tegmenal strut. The internal sac is visible on the sides of the seminal trough, irregularly burred.

5. *H. opacus* ER. (Figs. 15a, b, c)

The median lobe is elongate, evenly narrowing backwards. The posterior margin is markedly round. Lateral tops of the median lobe are strongly stretched frontwards. Protrudent lobes are completely separate from the median lobe.

Dorsal lobes are a little shorter than half of the median lobe length; overlapping much. They are the broadest in the mid-length, and their posterior margin is parabolic. Lateral lobes are distinct, nearly as long as the median lobe. The median struts are very close in the basal part and after the mid-length are characteristically bent. The tegmen is narrow, covering $3/4$ of the median lobe circumference, with the ends pointed; the tegmenal strut is acute, not very long. The internal sac is not visible.

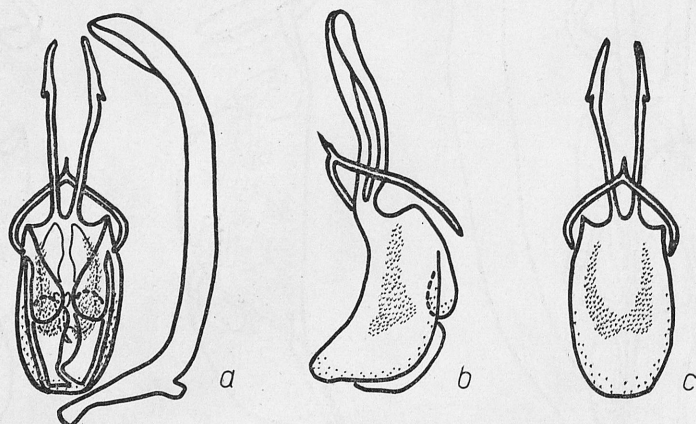


Fig. 14. Penis of *H. angustatus* HERBST in three positions; a, b, c as above
 Пенис *H. angustatus* HERBST в трех положениях; а, b, c, как выше
 Penis *H. angustatus* HERBST w trzech położeniach; a, b, c jak wyżej

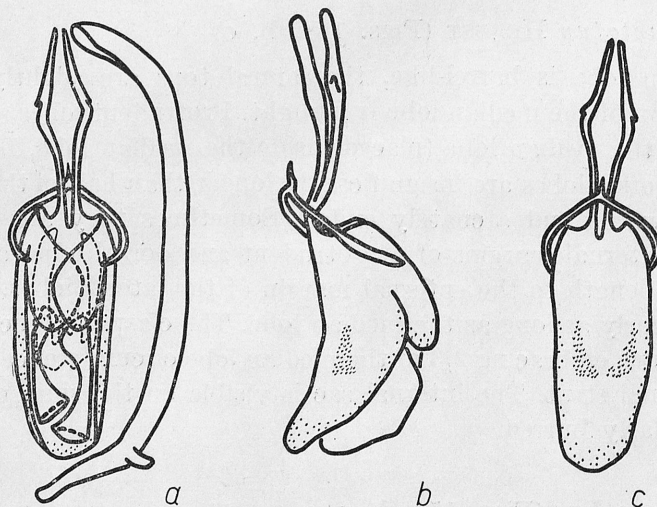


Fig. 15. Penis of *H. opacus* ER. in three positions; a, b, c as above
 Пенис *H. opacus* ER. в трех положениях; а, b, c, как выше
 Penis *H. opacus* ER. w trzech położeniach; a, b, c jak wyżej

6. *H. attenuatus* ER. (Figs. 16a, b, c)

The median lobe is bulgy, strongly constricting backwards after $2/3$ of its length. Lateral tops of the median lobe are sloping. Protrudent lobes are completely separate from the median lobe. Dorsal lobes are with a well-defined posterior margin. Lateral lobes are narrow, poorly-defined, attaining the mid-length of the median lobe. The clasp is trapezoid, with a straight anterior margin. The tegmen is narrow, covering $1/2$ of the median lobe circumference, the tegmenal strut is short, broad. The internal sac is very clear, like chain mail in the upper part.

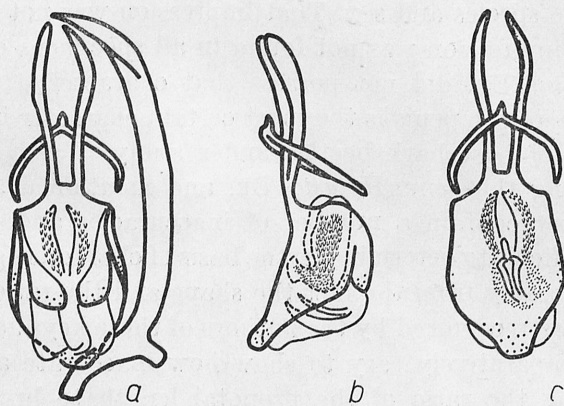


Fig. 16. Penis of *H. attenuatus* ER. in three positions; a, b, c, as above

Пенис *H. attenuatus* ER. в трех положениях; а, b, c, как выше

Penis *H. attenuatus* ER. w trzech położeniach; a, b, c jak wyżej

The lobes of the studied species are with transparent pits, sometimes bearing short hairs (as in *H. ater* PAYK). The penis structure is principally permanent, but there are some elements, however, which are subjected to minimal changes. The most striking are variations in the clasp, in the setting of median struts and in the structure of dorsal lobes. The existing variations do not make the identification difficult, since penises have quite a sufficient number of characters, which make possible an easy and certain determination.

Summation and discussion

Results of the performed studies permit to draw the following conclusions:

1. In the group of large bast bark beetles:

- specimens under study had a carina on their rostrum;
- sexual dimorphism (secondary characters) manifests itself clearly in the shape and pubescence of the 5th abdominal sternite;

- pubescence of the 5th abdominal sternite of males permits the determination of a species;
- pubescence of the elytral truncature and the shape of the pronotum make possible a correct identification of females;
- on account of great variation, the pronotal and elytral indices cannot be recognized as a diagnostic character;
- 2. In the group of small bast bark beetles:
 - specimens under study had no carina on their rostrum;
 - sexual dimorphism manifests itself poorly in the shape of the 5th abdominal sternite;
 - there is no correlation between a striated or foveate impression at the rostral base and the species and sex. That impression was not found in all species and sex. That impression was not found in all specimens of the mentioned species. *H. attenuatus* ER. did not possess that character.
- 3. The structure of the penis is the most certain character in the determination of six species of bast bark beetles under study.

Works concerning the genus *Hylastes* ER. and mentioned at the beginning of the present paper contain a number of inaccuracies and conflicting data. Some species are difficult to determine on the basis of characters given in available keys. This results mainly from the fact the shape and the ratio of the pronotal length to breadth are recognized by the authors of these keys as a distinguishing character. It is comparatively easy to show how inaccurate and divergent are the data concerning the ratio of the pronotal length to breadth (Table II).

Table II
Biometrical data concerning *H. ater* PAYK. and *H. brunneus* ER. according to some authors

Author	<i>H. ater</i> PAYK. Pronotal index		<i>H. brunneus</i> ER. Pronotal index	
	♂♂	♀♀	♂♂	♀♀
1. REITTER 1913	Considerably longer than broader		A little longer than broader	
2. BLAIR 1949	Pronotum longer		Pronotum shorter	
3. DUFFY 1953	Pronotum strongly elongated		Pronotum not elongated	
4. STRAND 1953	Longer than in <i>H. brunneus</i>		Not so long as that of <i>H. ater</i> *	
5. NUNBERG 1954	1.15	1.25	Shorter than that of <i>H. ater</i>	
6. HANSEN 1954	—		As long as broad	
7. PFEFFER 1955	1.15	1.20	1.07	1.12
8. LEKANDER 1965	1.20—1.24	1.22—1.27	1.10—1.22	1.12—1.24
9. SCHEDL 1968	Considerably longer than broader		—	
10. BEAVER 1970				
(-from Newbrough	1.15—1.30	1.16—1.33	—	
Waren				
-from Bramshill)	1.20—1.24	1.22—1.27	—	

* Following LEKANDER (1965)

This proves that by the use of this character and the pronotal shape it is impossible to identify all specimens with certainty, especially with regard to *H. ater* PAYK. and *H. brunneus* ER. It seems also doubtful that *H. ater* PAYK. differed from *H. brunneus* ER. by duller and more sculptured interstices (BLAIR 1949, DUFFY 1953, HANSEN 1954, LEKANDER 1965, BEAVER 1970). On the basis of the material examined we can state that variation of that character is so great that it excludes any certainty in the distinguishing of the mentioned species. During our morphological studies we found male specimens with slightly carved and shining interstices, which upon preparation of their copulatory organs, appeared to belong to *H. ater* PAYK. Among specimens of *H. brunneus* ER., sent by A. BAKKE from Norway and by LEKANDER from Sweden, there are such, whose interstices are more carved and dull than those of some specimens of *H. ater* PAYK. in the collections of the present authors. Specimens of *H. brunneus* ER., sent for these studies by Prof. M. NUNBERG, after the analysis of their morphological characters, appeared to be specimens of *H. ater* PAYK. The preparation of the penises of these specimens confirmed the determination made by the authors. NUNBERG himself had doubts as to a proper designation of the specimens sent by him (he attached the following note: „This is all I have, but all this is uncertain”). The error in determination resulted from the inaccuracy of morphological characters, which until now have been given as distinguishing traits for *H. ater* PAYK. and *H. brunneus* ER. The occurrence of *H. brunneus* ER. in Poland seems to be doubtful, although KARPÍŃSKI and STRAWIŃSKI (1948) report that *H. brunneus* ER. was found all through the former part of Poland under Russian domination (formed at the Congress at Vienna in 1815), in the Tatra Mountains, Cieszyński's Silesia and Białowieża. These authors give confusing characters for the above species, which are also included in other, known to us keys, based on the structure of male copulatory organs.

Some authors give a character, which is not too permanent. It concerns a striated impression at the base of rostrum in *H. angustatus* HERBST. Among the examined specimens of that species there were some without that character. NUNBERG (1954) reports that *H. opacus* ER. has no „foveate or striated impression on the snout in front of its base”. This character is not permanent, since some examined specimens of the above species had a foveate impression with a shining surface.

There were many wrong identifications in PFEFFER's collection, used by us for the present studies. Specimens of *H. aterrimus* EGG. and *H. rotundicolis* REITT. seemed to be wrongly identified already after the analysis of morphological characters. The preparation of the penises permitted to find that the males of these two species from PFEFFER's collections are specimens of *H. cunicularius* ER. While comparing morphological characters given in PFEFFER's keys (1944, 1955) for *H. cunicularius* ER., *H. aterrimus* EGG. and *H. rotundicolis* REITT., we may see that these species do not differ much from one another. HANSEN (1954), in turn, basing himself on the structure of male copulatory organs, found that *H. aterrimus* EGG. from the type series of EGGERS is identical to

H. brunneus ER. A beetle specimen, designated by LINDEMANN as *H. ater* PAYK. and later by STARK as *H. aterrimus* EGG., after the preparation of the penis made by the present authors, appeared to be *H. brunneus* ER., thus supporting an earlier observation of HANSEN (1954).

The authors have discussed variation of some species with the aim to draw attention to the most striking inaccuracies and wrong characters given in the hitherto papers.

Data concerning the structure of male copulatory organs in species from the genus *Hylastes* ER., presented in HANSEN (1954) and LEKANDER (1965), are not deprived of mistakes and obscurities. Drawings in the work by HANSEN (1954) are not only schematic, but, in addition, they do not present the whole penis. The fact, that penis is not presented as a whole, eliminates many distinguishing characters, which make determination possible, and, besides that, it makes the picture of the penis elements placed in the drawing deformed. These drawings present the shape of the median lobe very superficially in the group of „large bast bark beetles”, whereas in the group of „small bast bark beetles” they are completely useless. It is not clear why two forms of the penis for *H. opacatus* ER. are presented. Does that suggest the existence of aberration or even of a subspecies? LEKANDER (1965) additionally represented a drawing of the penis for *H. scandinavicus* sp. n., made in a similar manner as that in HANSEN and supplied with an equally scanty description, which clears little. Preparations of *H. attenuatus* ER. (Fig. 16a, b, c) are the closest to the drawing of *H. scandinavicus* LEK. It should be noticed that proportions in the drawings of *H. opacatus* ER., *H. attenuatus* ER. and *H. angustatus* HERBST (HANSEN 1954), as well as in the drawing of *H. scandinavicus* LEK. (LEKANDER 1965) are overdone, especially in the drawings of the penis seen from the side (compare figs. 14c, 15c, 16c). This is supported by drawings in TSAI PANG-HWA, HWANG FU-SCHENG (1964).

While analysing the above species, the authors tried to separate the most distinguishing morphological characters, which were used for the key given below. Upon receipt of other palaearctic species of the genus *Hylastes* ER. and after their analysis, there may be some changes in the present key. In the next paper devoted to this genus the authors will extend their studies on the male anatomy of the already discussed species and will try to characterize features and their variation in the remaining palaearctic species.

Acknowledgment

We wish to express our sincere thanks to Prof. B. LEKANDER, Stockholm, Forest Royal Collegé, Sweden, to Dr. A. BAKKE, Norwegian Forest Institute, Vollebekk, Norway, to Prof. M. NUNBERG, Warsaw, Poland, to Prof. A. PFEFFER, Prague, Czechoslovakia, to the Museum of the Zoological Institute in Leningrad,

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Identification Key to Species under Study on the Basis of their External Morphological Characters

1. There is a carina on the snout 2
- There is no carina on the snout 6
2. Pronotum constricted anteriorly, the body of beetles stocky (Figs. 8e, f).
5th abdominal sternite of males with a striated impression bearing long, straight, recumbent hairs, directed towards the apex (Fig. 10f).
5th abdominal sternite of females has no striated impression with long, setaceous hairs (Fig. 10e) ♂♂, ♀♀ *H. cunicularius* ER.
- Pronotum is not constricted anteriorly, the body elongated 3
3. Elytral truncature with a single row of protruding hairs and irregularly spaced, recumbent scales on each interstice 4
- Elytral truncature with three rows of recumbent hairs on interstices ♀♀ *H. ater* PAYK.
4. 5th abdominal sternite with a striated impression bearing long, setaceous hairs. 5
- 5th abdominal sternite without impression bearing long, setaceous hairs (Fig. 10c) ♀♀ *H. brunneus* ER.
5. Long hairs on 5th abdominal sternite arranged radially, recumbent (Figs. 9c, 10b) ♂♂ *H. ater* PAYK.
- Long hairs on 5th abdominal sternite are unevenly protruding and characteristically parted (Figs. 9d, 10d). ♂♂ *H. brunneus* ER.
6. Interstices from elytral base to apex are with protruding hairs arranged in a single row ♂♂, ♀♀ *H. attenuatus* ER. *
- The second and next interstices with a double row of hairs (on elytral truncature hairs are arranged in a single row). 7
7. Pronotum markedly constricted anteriorly, body stocky (see from the abdominal side). ♂♂, ♀♀ *H. opacus* ER. *

* Sex of individual specimens in the group of small bast bark beetles may be determined on the basis of differences in the shape and structure of the 5th abdominal sternite. Males — the 5th abdominal sternite is flat with a straight anterior margin. Females — the 5th abdominal sternite is convex, with the anterior margin arcuately curved frontwards.

- . Pronotum slightly constricted anteriorly, beetles slender (see from the abdominal side)
 ♂♂, ♀♀ *H. angustatus* HERBST *

Identification Key to Males of Species under Study on the Basis of Penis Structure

1. Tegmen without tegmenal strut, protrudent lobes are not completely separate from median lobe (Fig. 13a, b, c)
 *H. cunicularius* ER.
- . Tegmen with a tegmental strut, protrudent lobes are completely separate from median lobe 2
2. Median lobe with a step-like bend in mid-length on abdominal sides (Fig. 11a, b, c)
 *H. ater* PAYK.
- . Median lobe without a step-like bend in mid-length on abdominal sides 3
3. Apical part strongly constricted, protrudent lobes asymmetrically arranged, visible from abdominal side (Fig. 12a, b, c)
 *H. brunneus* ER.
- . Apical part rounded or slightly constricted, protrudent lobes invisible from abdominal side 4
4. Internal sac well-defined, like chain male in upper part, dorsal lobes have only posterior margin well-marked (Fig. 16a, b, c)
 *H. attenuatus* ER.
- . Internal sac invisible or poorly-defined on sides of seminal trough, dorsal lobes well-defined, oval, may overlap 5
5. Median lobe laterally flattened, internal sac invisible, median struts narrowly spaced and characteristically bent after mid-length (Fig. 15a, b, c)
 *H. opacus* ER.
- . Median lobe cylindrical, internal sac slightly defined on sides of seminal trough (Fig. 14a, b, c)
 *H. angustatus* HERBST

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STRESZCZENIE

W pracy niniejszej autorzy przedstawili wyniki badań dotyczących zmienności osobniczej i dymorfizmu płciowego niektórych palearktycznych gatunków z rodzaju *Hylastes* ER. (*H. ater* PAYK., *H. brunneus* ER., *H. cunicularius* ER., *H. opacus* ER., *H. attenuatus* ER., *H. angustatus* HERBST). Wyniki analizy matematycznej wykonanej dla *H. ater* PAYK., porównywalne z podobnymi analizami wykonanymi dla *H. ater* PAYK. i *H. brunneus* ER. przez innych autorów, pozwalają stwierdzić, że posługiwanie się współczynnikiem długości do szerokości przedplecza i pokryw w celach oznaczeniowych nie daje pewności odróżniania powyższych dwóch gatunków. Dotyczy to również pozostałych przebadanych gatunków z uwagi na duże zmienności wartości wymienionych współczynników. Również inne charakterystyczne cechy morfologiczne podawane w dostępnych nam publikacjach i kluczach są bardzo zmienne i subtelne, co obniża, a nawet pozbawia je zupełnie wartości cech gatunkowych.

Badania pozwoliły ustalić jednak cechy, za pomocą których pewnie określić można gatunek i płeć w grupie zakorków dużych (*H. ater* PAYK., *H. brunneus* ER., *H. cunicularius* ER.) oraz gatunek w grupie zakorków małych (*H. opacus*

ER., *H. attenuatus* ER., *H. angustatus* HERBST). Oznaczenia płci zakorków małych dokonać można na podstawie różnic w kształcie i budowie piątego segmentu odwłoka.

Sporządzono również preparaty mikroskopowe i rysunki penisów sześciu badanych gatunków. Rysunki przedstawiają narządy kopulacyjne samców w trzech położeniach (od strony grzbietowej, brzusznej i z boku). Zamieszczone są także opisy penisów uzupełnione nową terminologią, przyjętą przez autorów, celem podkreślenia ważności poszczególnych elementów dla determinacji gatunku.

Występowanie *H. brunneus* ER. w Polsce wydaje się być wątpliwe.

Na podstawie cech istotnie różniących opracowano klucze do oznaczania przebadanych gatunków.

Klucz do oznaczania gatunków na podstawie zewnętrznych cech morfologicznych

1. Na ryjku znajduje się kil 2
- Na ryjku brak kila 6
2. Przedplecze w przedniej części przewężone, chrząszcze krępej budowy ciała (rys. 8 e, f). Na piątym segmencie odwłoka samców bruzdkowate zagłębienie, z którego wyrastają długie, proste, przylegające, skierowane ku apeksowi włoski (rys. 10f). Na piątym segmencie odwłoka samce brak bruzdkowatego zagłębienia z długimi szczeciniastymi włoskami (rys. 10 e)
. ♂♂, ♀♀ *H. cunicularius* ER.
- Przedplecze bez przewężenia w przedniej części, chrząszcze o wydłużonej sylwetce ciała 3
3. Na ścięciu pokryw, na międzyrzędach pojedynczy szereg odstających włosków i nieregularnie rozmieszczone, przylegające łuseczki. 4
- Na ścięciu pokryw na międzyrzędach trzy szeregi przylegających włosków
. ♀♀ *H. ater* PAYK.
4. Na piątym segmencie odwłoka bruzdkowate zagłębienie, z długimi szczeciniastymi włoskami 5
- Na piątym segmencie odwłoka brak zagłębienia z długimi szczeciniastymi włoskami (rys. 10 c)
. ♀♀ *H. brunneus* ER.
5. Długie włoski na piątym segmencie odwłoka, ułożone promieniowo, przylegające (rys. 9 c, 10 b)
. ♂♂ *H. ater* PAYK.
- Długie włoski, na piątym segmencie odwłoka równomiernie odstające, ułożone w charakterystyczny przedziałek (rys. 9 d, 10 d)
. ♂♂ *H. brunneus* ER.
6. Na międzyrzędach, od nasady do końca pokryw, odstające włoski, ułożone w jednym szeregu ♂♂, ♀♀ *H. attenuatus* ER. *

- Na drugim i dalszych międzyrzędach, włoski ułożone w dwóch szeregach (na ścięciu pokryw jeden szereg odstających włosków na każdym międzyrzędzie) 7
- 7. Przedplecze w przedniej części wyraźnie przewężone, chrząszcze krępej budowy ciała (patrz od strony brzusznej chrząszcza)
. ♂♂, ♀♀ *H. opacus* ER. *
- Przedplecze lekko przewężone w przedniej części, chrząszcze smukłej budowy ciała (patrz od strony brzusznej chrząszcza)
. ♂♂, ♀♀ *H. angustatus* HERBST *

Klucz do oznaczania samców badanych gatunków na podstawie budowy penisów

- 1. Uszko bez znamienia, płaty odcięte, niecałkowicie oddzielone od korpusu (rys. 13a, b, c) *H. cunicularius* ER.
- Uszko ze znamieniem, płaty odcięte, całkowicie oddzielone od korpusu 2
- 2. Korpus ze schodkowatym zagięciem w połowie długości po bokach strony brzusznej (rys. 11a, b, c)
. *H. ater* PAYK.
- Korpus bez schodkowatego zagięcia w połowie długości po bokach strony brzusznej. 3
- 3. Część apikalna silnie przewężona, płaty odcięte, ułożone niesymetrycznie, widoczne od strony brzusznej (rys. 12a, b, c)
. *H. brunneus* ER.
- Część apikalna zaokrąglona lub lekko przewężona, płaty odcięte, niewidoczne od strony brzusznej 4
- 4. Pokrowiec wyraźnie zaznaczony, w górnej części koleżugowaty, płaty grzbietowe z wyraźnie zaznaczoną tylko tylną krawędzią (rys. 16a, b, c)
. *H. attenuatus* ER.
- Pokrowiec niewidoczny lub słabo zaznaczony po bokach rynienki, płaty grzbietowe wyraźnie zaznaczone, owalne, mogą zachodzić na siebie 5
- 5. Korpus bocznie spłaszczony, pokrowiec niewidoczny, nóżki wąsko osadzone, charakterystycznie załamane poza połowę swej długości (rys. 15a, b, c)
. *H. opacus* ER.
- Korpus wałcowaty, pokrowiec lekko zaznaczony po bokach rynienki (rys. 14a, b, c) *H. angustatus* HERBST

* Płeć poszczególnych okazów w grupie zakorków małych określić można na podstawie różnic kształtów i budowy piątego segmentu odwłoka. Samice — powierzchnia piątego segmentu odwłoka jest wypukła a przedni brzeg łukowato wygięty ku przodowi. Samce — powierzchnia piątego segmentu odwłoka jest płaska, a przedni brzeg prosty.

В настоящей работе авторы представили результаты исследований, касающихся индивидуальной изменчивости и полового диморфизма некоторых палеарктических видов рода *Hylastes* ER. (*H. ater* PAUK., *H. brunneus* ER., *H. cunicularius* ER., *H. opacus* ER., *H. attenuatus* ER., *H. angustatus* HERBST). Результаты математического анализа для *H. ater* PAUK. которые можно сравнить с подобными анализами, проведенными другими авторами для *H. ater* PAUK. и *H. brunneus* ER., позволяют заключить, что использование коэффициента длины к ширине переднеспинки и надкрылий с целью определения видов не дает уверенности в разграничении двух вышеупомянутых видов.

Другие характерные морфологические признаки в существующих публикациях и определительных таблицах являются очень изменчивыми и утонченными, что снижает и даже совершенно лишает их значения видовых признаков.

Настоящие исследования позволили, однако, установить признаки, с помощью которых можно с уверенностью определить вид и пол в группе больших корнежиллов (*H. ater* PAUK., *H. brunneus* ER., *H. cunicularius* ER.) а также вид в группе малых корнежиллов (*H. opacus* ER., *H. attenuatus* ER., *H. angustatus* HERBST). Определение пола малых корнежиллов можно произвести на основании разниц в форме и структуре 5-го сегмента брюшка. Сделаны также микроскопические препараты и рисунки пенисов шести исследованных видов. Рисунки представляют копулятивные органы самцов в трех положениях (с дорсальной, брюшной стороны и сбоку). В работе помещены также описания пениса, восполненные новой терминологией, принятой авторами, чтобы подчеркнуть значение отдельных элементов для определения вида.

Авторы ставят под сомнение выступление *H. brunneus* ER. в Польше.

На основе существенно дифференцирующих признаков составлена определительная таблица для исследованных видов.

Определительная таблица исследованных видов на основе морфологических признаков

- | | |
|--|---|
| 1. На рострум имеется киль | 2 |
| — На рострум нет кия. | 6 |
| 2. Переднеспинка в передней части сужена, жуки коренастой структуры тела (Рис. 8e, f) | |
| На 5-ом сегменте брюшка самцов бороздчатое вдавление, из которого растут длинные, прямые, прилегающие волоски, направленные к апексу (Рис. 10 f) | |
| На 5-ом сегменте брюшка самок нет бороздчатого вдавления с длинными, щетинистыми волосками (Рис. 10 e) | |
| ♂♂, ♀♀ <i>H. cunicularius</i> ER. | |
| — Переднеспинка без сужения в передней части, жуки с удлинненным силуэтом тела | 3 |

3. На срезе надкрылий на междурядьях один ряд отстающих волосков и нерегулярно размещенные, прилегающие чешуйки 4
- На срезе надкрылий на междурядьях по три ряда прилегающих волосков ♀♀ *H. ater* РАУК.
4. На 5-ом сегменте брюшка бороздчатое вдавление с длинными, щетинскими волосками 5
- На 5-ом сегменте брюшка нет вдавления с длинными, щетинсистыми волосками (Рис. 10 с) ♀♀ *H. brunneus* ЕР.
5. Длинные волоски на 5-ом сегменте брюшка уложены лучеобразно, прилегающие (Рис. 9 с, 10 b) ♂♂ *H. ater* РАУК.
- Длинные волоски на 5-ом сегменте брюшка равномерно отстающие, уложены в характерный пробор (Рис. 9 d, 10 d) ♂♂ *H. brunneus* ЕР.
6. На междурядьях от основания до конца надкрылий отстающие волоски, уложенные в один ряд ♂♂, ♀♀ *H. attenuatus* ЕР. *
- На втором и следующих междурядьях волоски уложены в два ряда (на срезе надкрылий один ряд отстающих волосков на каждом междурядье). 7
7. Переднеспинка в передней части явно сужена, жуки коренастой структура тела (см. с брюшной стороны жука) ♂♂, ♀♀ *H. opacus* ЕР. *
- Переднеспинка слегка сужена в передней части, жуки тонкие (см. с брюшной стороны жука). ♂♂, ♀♀ *H. angustatus* HERBST *

Определительная таблица самцов исследованных видов на основе строения пениса

1. Ушко без отростка, отстающие пластинки не целиком отделены от корпуса (Рис. 13 а, b, с). *H. cunicularius* ЕР.
- Ушко с отростком, отстающие пластинки целиком отделены от корпуса 2
2. Корпус со ступенчатым перегибом в половине длины по бокам брюшной стороны (Рис. 11а, b, с) *H. ater* РАУК.
- Корпус без ступенчатого перегиба в половине длины по бокам брюшной стороны 3

* Пол отдельных экземпляров в группе малых корнежилов можно определить на основе разниц в форме и структуре 5-го сегмента брюшка. Самки — поверхность 5-го сегмента брюшка выпуклая, а передний край другообразно выгнут вперед. Самцы — поверхность 5-го сегмента брюшка плоская, а передний край прямой.

3. Апикальная часть сильно сужена, отстающие пластинки уложены не симметрично, видны с брюшной стороны (Рис. 12 а, b, c) *H. brunneus* Er.
- Апикальная часть округлена или слегка сужена, отстающие лопасти не видны с брюшной стороны 4
4. Семенной мешок ясно очерчен, в верхней части кольчугообразный, дорсальные пластинки имеют ясно обозначенный только задний край (Рис. 16 а, b, c) *H. attenuatus* Er.
- Семенной мешок невидим или слабо обозначенный по бокам дуктуса, дорсальные пластинки ясно обозначены, овальные, могут заходить одна на другую 5
5. Корпус по бокам уплощенный, семенной мешок невидим, ножки узко установлены и характерно согнуты за половиной своей длины (Рис. 15 а, b, c) *H. opacus* Er.
- Корпус цилиндрический, семенной мешок слегка обозначен по бокам дуктуса (Рис. 14 а, b, c) *H. angustatus* HERBST

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